Supplementary Information (SI) for Sustainable Energy & Fuels.

Supporting Information

Enhanced Ketonic Decarboxylation of Fatty Acids using Vanadia-modified Ni/ZrO_2 Catalyst

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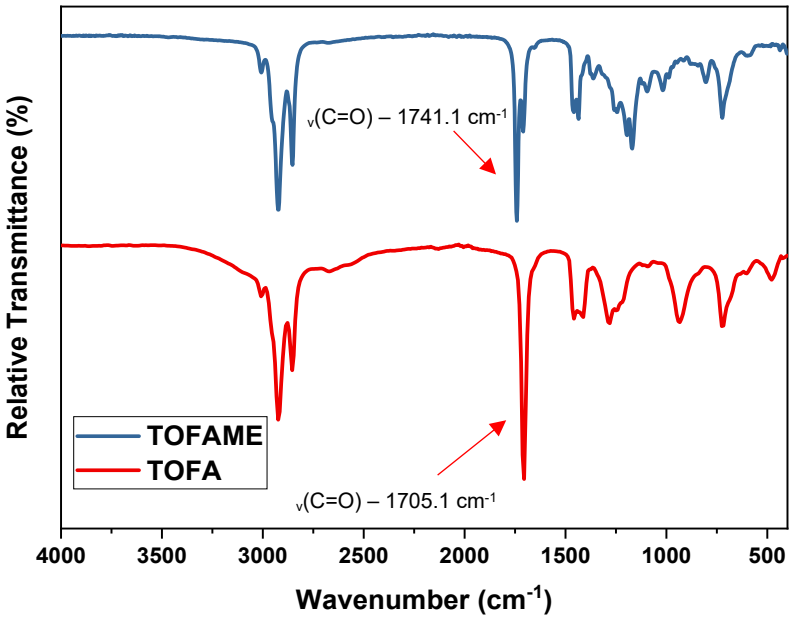

Fig. S1: FT-IR spectra of TOFA and TOFAME.

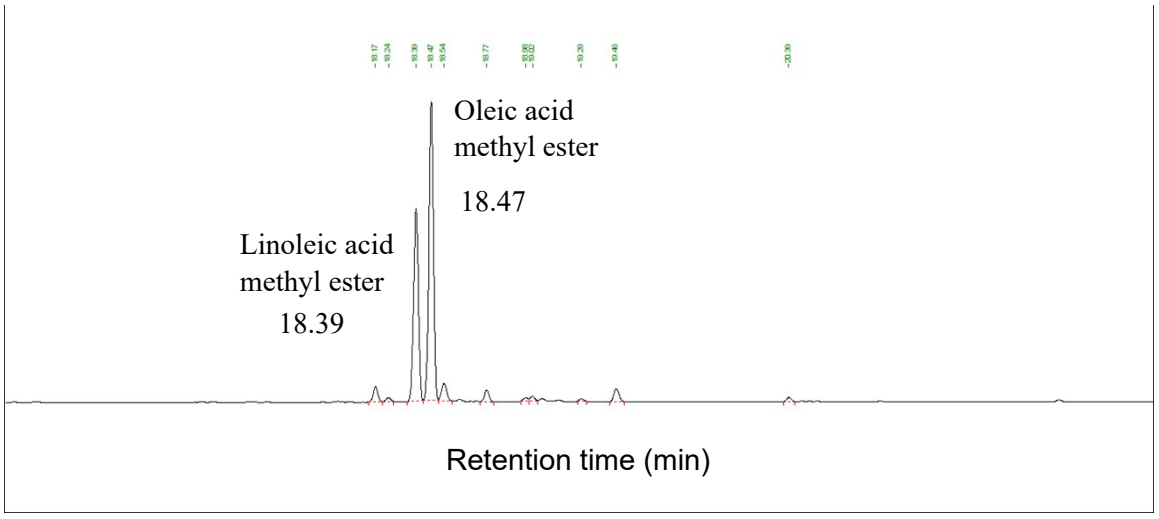

Fig. S2: TOFAME GC-FID graph.

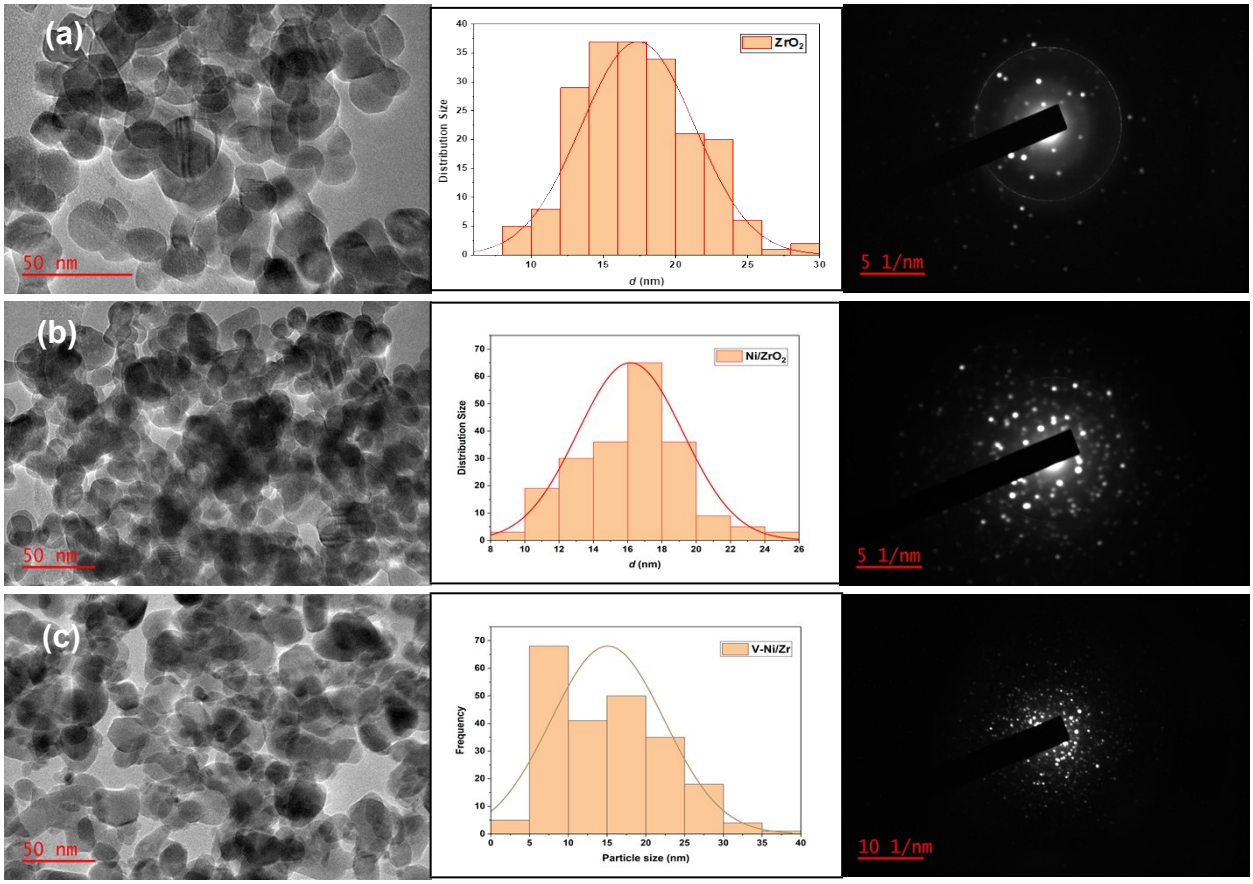

Fig. S3: TEM images, particle size distribution, and SAED images of (a)ZrO_2, (b)Ni/ZrO_2, and (c) V-Ni/ZrO_2.

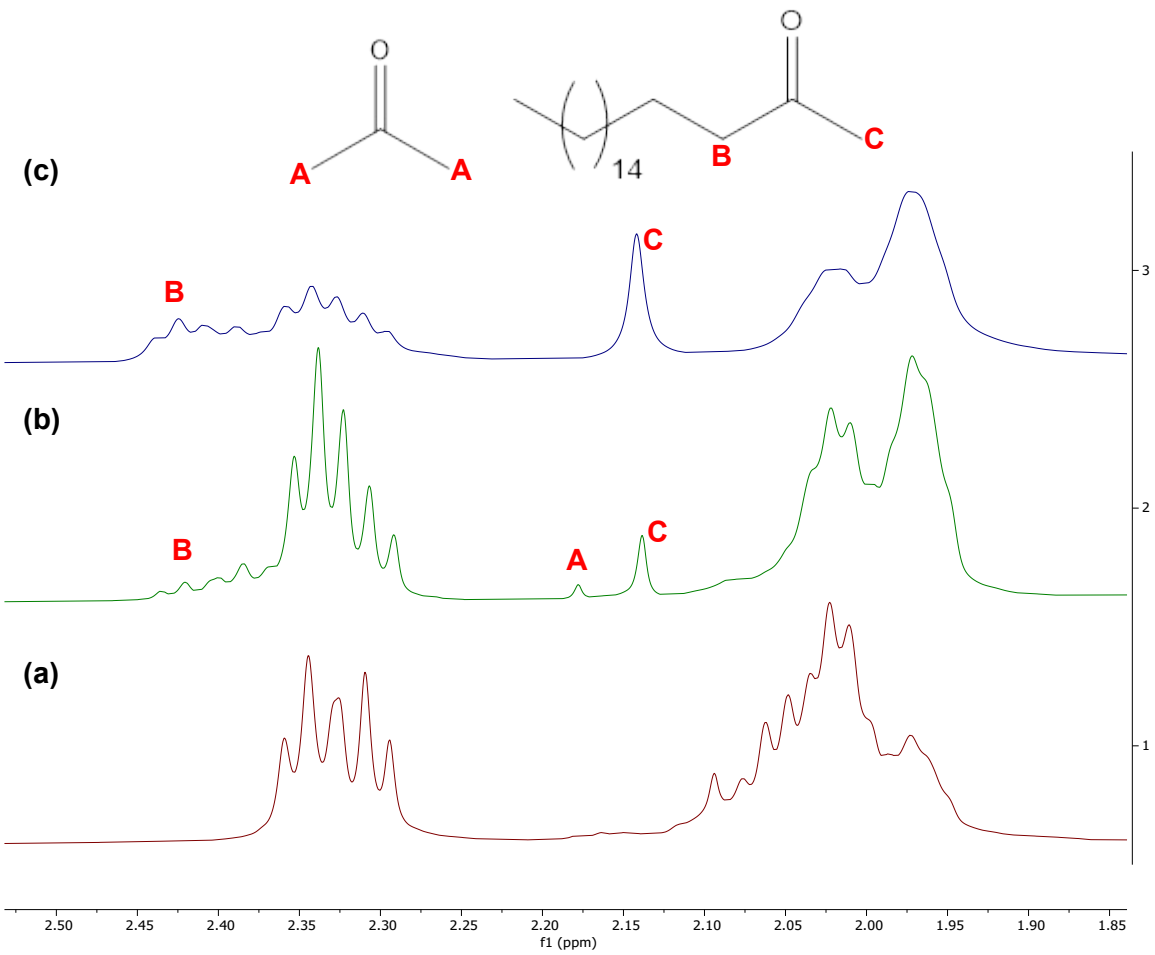

Fig. S4: ^{1}H NMR spectral overlay highlighting characteristic ketone signals for self-ketonization products, nonadecanone and acetone, at (a) 250 °C for 5 h, (b) 300 °C for 5 h, and (c) 350 °C for 5 h.

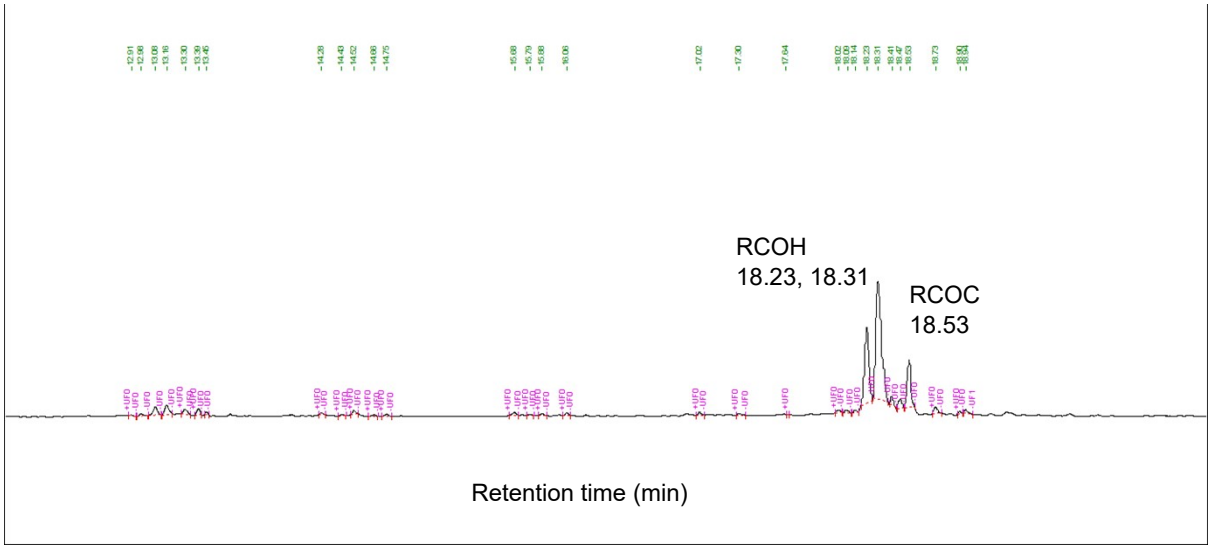

Fig. S5: GC-FID data of TOFA deoxygenation over NiO catalyst at 350 °C/5 h.

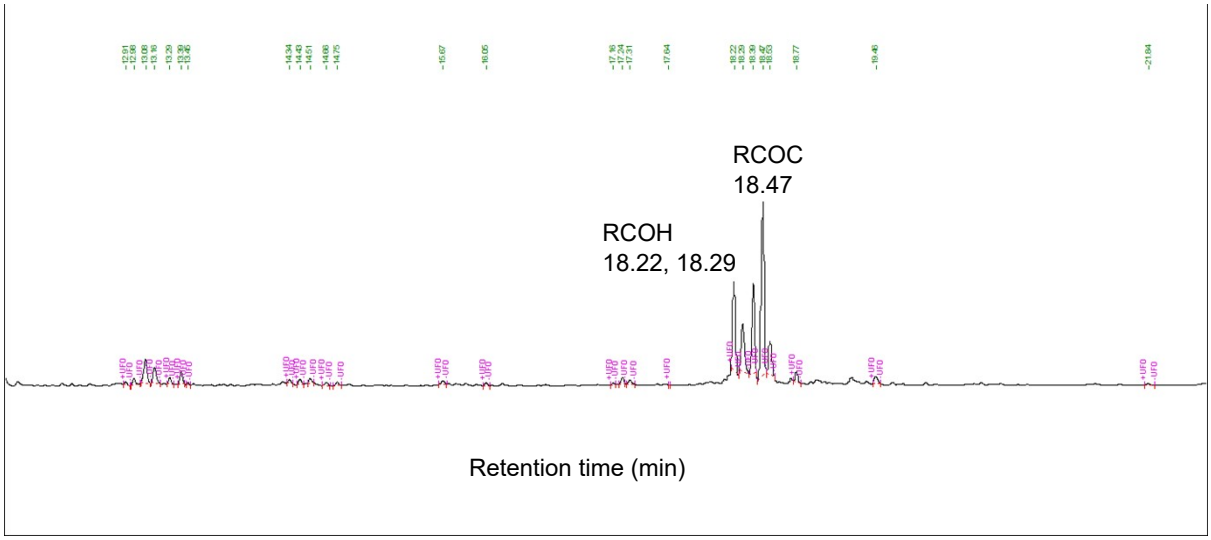

Fig. S6: Product profile of TOFA deoxygenation over ZrO_2 support at 350 °C/5 h.

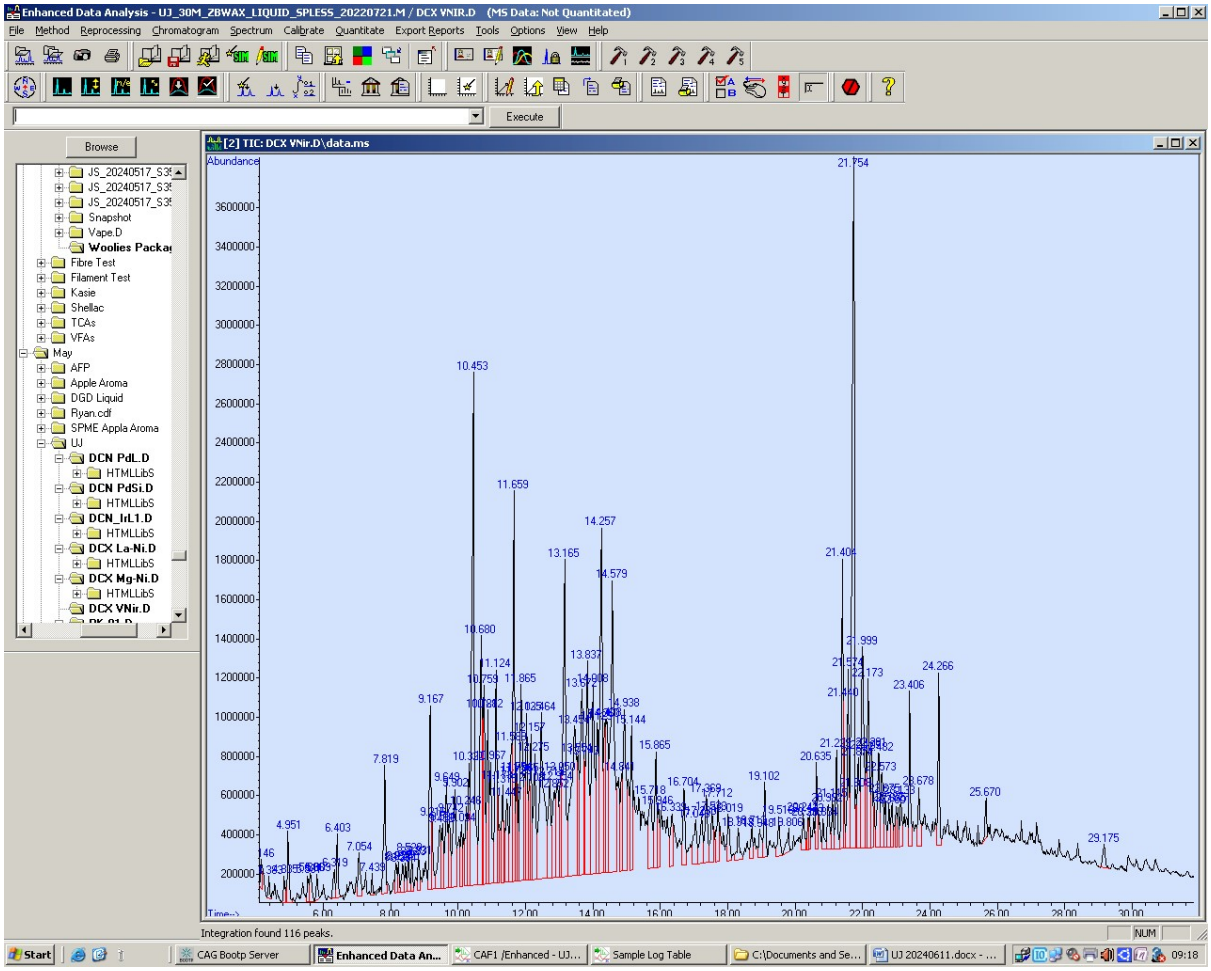

Fig. S7: GC-MS data of TOFA deoxygenation over the V-NiZrO$_2$ catalyst at 350 °C/15 h.

Table S1: GC-MS product assignments.

Entry	Compound	Retention Time (min)
1	Dodecane, C_{12} (solvent)	4.34
2	Tridecane, C_{13}	5.11
3	Tetradecane, C_{14}	6.50
4	1-Tetradecene, C_{14}	7.13
5	Pentadecane, C_{15}	7.90
6	1-Pentadecene, C_{15}	8.48
7	Hexadecane, C_{16}	9.17
8	7-Hexadecene, C_{16}	9.92
9	Heptadecane, C_{17}	10.40
10	Octadecane, C_{18}	11.61
11	Octadecene, C_{18}	12.12
12	15-Heptadecenal, C_{12}	12.24
13	5-Octadecene	12.42
14	1-Nonadecene	12.25
15	3-Undecene-2-methyl	13.98
16	2-Nonadecanone	21.67
17	Stearic acid	29.90
18	Oleic acid	30.44
19	17-Pentatriacontene	30.49

Table S2: Comparable deoxygenation systems reported in literature.

Entry	Catalyst	Feedstock	Conditions	Conversion (%)	C_{17} (%)	C_{18} (%)	Ref.
1	1%Pd/C	TOFA	350 °C, 5.5 h, H_2 atm.	59	91	-	[1]
2	80%NiZrN/U	SO	350 °C, 2 h, N_2 atm.	99	35	-	[2]
3	Ir-ReOx/SiO_2	WCO	180 °C, 18 h, 20 bar H_2.	82	-	69	[3]
4	5%Pd/C	FAME	340 °C, 6 h, 25 bar H_2.	95	87	9	[4]
5	10%Mo/γ-Al_2O_3	OA	375 °C, 4 h, hydrothermal.	91	18	-	[5]
6	30% Ni/ZrO_2	OA	350 °C, 3 h.	100	23	-	[6]
7	10% Ni/ZrO_2	TOFA	350 °C, 5 h, 10 bar H_2 & FA.	90	20	8	This work
8	2%V-8%Ni/ZrO_2	TOFA	350 °C, 5 h, 10 bar H_2 & FA.	94	30	9	This work

References

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